

APPLICATION

FOR

UNITED STATES LETTERS PATENT

FOR

DEVICE FOR ATTACHING RETURN SPRINGS IN A HARNESS
OF A JACQUARD WEAVING MACHINE

Claiming Priority of Belgian
Application No. 2002/0451 filed July 19, 2002

BY

Bram VANDERJEUGT
and
Yvan LAUWEREYS

James C. Wray, Reg. No. 22,693
Meera P. Narasimhan, Reg. No. 40,252
1493 Chain Bridge Road
Suite 300
McLean, Virginia 22101
Tel: (703) 442-4800
Fax: (703) 448-7397

DEVICE FOR ATTACHING RETURN SPRINGS IN A HARNESS OF A
JACQUARD WEAVING MACHINE

On the one hand, the invention relates to a device for
5 exerting a return force on at least one harness element of
the harness of a Jacquard weaving machine, comprising at
least one return spring provided with means of attachment
in order to attach the return spring to retaining means
10 immovably provided. On the other hand, the invention
relates to a device for immovably installing the retaining
means of one or several return springs of a jacquard
weaving machine, the device being provided with at least
two fixed installing elements for installing the retaining
means.

15 In a Jacquard machine, one or several return springs are
applied at the bottom of the harness, in order to tighten
the Jacquard heddle, the harness cord, the tackles, the
tackle cords and the two complementary hooks, so that the
20 noses of the hooks will be kept permanently in touch with
the blades or, in case of a selection, will certainly stay
on the suspension means. The spring force of these return
springs at the bottom of the harness will compensate the
tension of the pile warp yarn, the inertia and the
25 friction of the heddles, of the harness cord, of the
tackles with their cords and of the hooks. Most of the
time, the return springs are connected to a fastening
piece, which is provided with a hook, by which each return
spring is attached to a board, called flat bar, which is
30 built-in in the machine. This fastening piece may be
screwed onto the return spring, which is or is not
provided with damping means (= element of synthetic
material situated in the return spring in order to prevent
the extremity of the return spring from absorbing the
35 heaviest chocks). The hook is usually a metal hook, which

is hooked onto the flat bar.

This design has the disadvantage, that the return springs which have been installed on the flat bar next to one
5 another, are not self-gripping what causes the return springs to loose their exact positions, each time the harness is released and because of this the position of the return springs in the warp direction becomes uncertain and no longer in correspondence with the pitch of the
10 cumber board. Because of this, friction in the harness will increase or it may lead to a hooking together of the springs in case of major dimensional deviations. When the foremost return springs are shifting forward too far they may collide with the reed. The shed also may change in
15 consequence of the position lost in the warp direction, because of which the rapier may collide with the shed.

In order to better secure the position in the warp direction designs are known where the return spring is
20 glued to the flat bars.

This has the disadvantage that replacement on site becomes very difficult.

25 Another design consists in bringing in spacers on the flat bars between the various return springs and then tightening the whole.

However this design has the disadvantage that a large variety of spacers are required with different thicknesses
30 requiring quite some work for installation. Here, replacements on site are also labor-intensive.

Another solution to be applied is overmoulding the flat bars. During the production process of the hooks, the flat
35 bars are inserted, so that the hooks are overmoulded

directly at the distances required.

The disadvantage of this method is that a large number of parts have to be overmoulded simultaneously. Besides, this
5 production method is hardly flexible and replacement on site becomes very difficult.

On the one hand, the purpose of the invention is to provide a device for exerting a retracting force on at
10 least one harness element of the harness of a Jacquard weaving machine, not having the above-mentioned disadvantages.

Furthermore, an additional purpose of the invention is to be able to position the return spring exactly on the flat
15 bars, without the position being changed during transport or operating conditions.

Furthermore a purpose is to obtain a harness with a minimum friction and reducing collisions between the various harness components to a minimum.

20

These purposes are obtained by providing a device for exerting a retractive force on at least one harness element of the harness of a Jacquard weaving machine, comprising at least one return spring which is provided
25 with means of attachment for attaching the return spring to the retaining means which are immovably provided, but the means of attachment being provided with a positioning opening for positioning the means of attachment with respect to the retaining means and a fixing opening for
30 fixing the means of attachment to the retaining means, a spring connection being provided between the positioning and the fixing openings such, that the means of attachment may move from the positioning opening to the fixing opening with respect to the retaining means, but after
35 having been fixed will be unable to move back from the

fixing opening to the positioning opening with respect to the retaining means during operation or transport of the Jacquard weaving machine.

5 This has the advantage that the return springs may be positioned exactly on the retaining means through such means of attachment, it being possible to maintain the same pitch for the bottom frame as well as for the cumber
10 board. Because of this, the harness functions with a minimum of friction and with a minimum number of collisions between the various components. Furthermore the return springs will be prevented from shifting forward and therefore no collisions with the reed will occur. Preventing the return springs from shifting backward and
15 forward will ensure that the configuration of the shed will not be changed, so that any problems during weaving will be avoided.

In a preferred embodiment of a device according to the
20 invention the positioning opening, where it is connected to the fixing opening, is provided with a beveled edge for guiding the motion of the means of attachment with respect to the retaining means from the positioning opening to the fixing opening.

25 This has the advantage that it has become easier to retract the retaining means into the fixing opening of the means of attachment.

30 In an advantageous preferred embodiment of a device according to the invention, the fixing opening, where it is connected to the positioning opening, is provided with a sharp and practically flat edge, such that after the means of attachment having been fixed with respect to the
35 retaining means, the means of attachment are no longer

able to move back from the fixing opening to the positioning opening during operation or transport of the Jacquard weaving machine.

- 5 In a more advantageous preferred embodiment of the device according to the invention, the spring connection between the positioning opening and the fixing opening is provided with at least two protrusions situated opposite one another.
- 10 This ensures that the motion of the retaining means from the fixing opening to the positioning opening is made still more difficult.
- 15 In the most advantageous preferred embodiment of a device according to the invention, the protrusion, situated in the spring connection on the side of the fixing opening, is provided in order to engage a recess provided in the retaining means.
- 20 In this manner, the means of attachment are no longer able to move from the fixing opening to the positioning opening.
- 25 Preferably, the retaining means are carried out in the form of a flat bar, at least one recess being provided on at least one side of the flat bar for the means of attachment to be fixed to the flat bar.
- 30 More preferably, at least one recess is provided on two sides of the flat bar for the means of attachment to be fixed to the flat bar.
- Still more preferably, the flat bar, on two sides, is
35 provided with several recesses in order to be able to fix

several means of attachment to the flat bar.

Another disadvantage of the known means of attachment described above is that the hook is a metal hook. Because
5 of this there is more clearance between the hook and the flat bar and vibrations will occur. Furthermore the metal hook will easily detach itself from the flat bar.

An additional purpose of the invention therefore consists
10 in providing a device having one or several of the characteristics of this invention, but the clearance between the means of attachment and the retaining means is less, and the means of attachment will become less easily detached from the retaining means.

15 These purposes are obtained by providing a device according to the present invention, the means of attachment being made of synthetic material.

20 The combination of means of attachment and retaining means made of synthetic material in the shape of flat bars is suitable for regulating the return springs very easily when pre-leveling the harness and to pre-install them on the flat bars and to secure them in that position.

25 Furthermore it is known in a Jacquard weaving machine to suspend the flat bars in the recesses of two plates which are laterally attached to the outside of the back and the front of a frame. This frame consists of two tubes, which
30 are connected to one another by connecting pieces.

One the one hand, the disadvantages of such a design are that it takes up much space as to height and on the other hand it is composed of a large number of components.

35

On the other hand therefore, the purpose of the invention is to provide a device for immovably installing the retaining means of one or several return springs of a Jacquard weaving machine not having the above-mentioned
5 disadvantages.

This purpose of the invention is achieved by providing a device for immovably installing the retaining means of one or several return springs of a Jacquard weaving machine,
10 the device being provided with at least two fixed installing elements for installing the retaining means, but said installing elements being provided with one or several recesses to install the retaining means.

15 By directly installing the retaining means in the two fixed installing elements, the total height may be reduced and moreover the construction has a good deal less components which reduces the time for installation and the price.

20 In a preferred embodiment of a device according to the invention, the said installing elements have the shape of a tube, each tube being provided with one or several grooves in order to insert the retaining means.

25 In a specific preferred embodiment of the device according to the invention, said retaining means consist of a flat bar, several recesses being provided on two sides of the flat bar for fixing several return springs to the flat bar
30 and the two other sides of the flat bar being provided for being inserted into said grooves of the tubes.

In an advantageous preferred device according to the invention, said tubes are put at an over- or
35 subatmospheric pressure in order to keep said flat bars

free of dust.

This invention will now be further explained by means of the following detailed description of a preferred
5 embodiment according to the invention. The intention of this description is exclusively to give a clarifying example and to indicate the further advantages and particulars of the present invention and may therefore in no way interpreted as a restriction of the field of
10 application of the invention or of the patent right demanded for in the claims.

In this detailed description reference is made, by means of reference numbers, to the attached drawings in which:

- 15 - in figure 1 a means of attachment is represented for attaching a return spring to a flat bar of a Jacquard weaving machine according to the state-of-the-art;
- in figure 2 a means of attachment is represented for
20 attaching a return spring to a flat bar of a Jacquard weaving machine according to the invention;
- in figure 3 a first embodiment of a flat bar of a Jacquard weaving machine according to the invention is represented;
- 25 - in figure 4 a second embodiment of a flat bar according to the invention is represented;
- in figure 5 a first embodiment of a means of attachment according to the invention is represented;
- 30 - in figure 6 a second embodiment of a means of attachment according to the invention is represented;
- in figure 7 a third embodiment of a means of
35 attachment according to the invention is represented;

- in figure 8 a third embodiment of a flat bar according to the invention, working together with the third embodiment of a means of attachment according to the invention, as represented in figure 6, is represented;
- in figure 9 a device is represented for immovably installing one or several flat bars in a Jacquard weaving machine provided with two fixed installing elements for installing the retaining means.

10

In a Jacquard machine each hook is connected to one or several cords, the whole of the cords being called the harness. The extremity of each cord is connected to a heddle eye through which a warp yarn is running, in order to form a shed by an up and down movement of the heddle eye and consequently also of the warp yarn. The heddle eye is connected to the frame of the Jacquard weaving machine by means of a return spring, which is usually connected to means of attachment on retaining means, more particularly a flat bar, which is provided immovably, preferably by incorporating it in the Jacquard weaving machine.

As shown in figures 1 and 2 the means of attachment (1) are preferably screwed onto the return spring (2). Damping means (20) have been provided or not. As shown in figure 2, these damping means (20) are built-in, to prevent the extremity of the return spring (2) from absorbing the heaviest chocks. Preferably, these damping means (20) consist of an element made of synthetic material which is situated in the return spring (2).

According to the state-of-the-art, the means of attachment (1) are provided with a hook (3), which usually is made of metal. This metal hook (3) is hooked onto a flat bar (4), as shown in figures 3 and 4.

As represented in figure 3 at least one recess (5) has been provided on at least one side of the flat bar (4) in order to fix the means of attachment (1) in an exact position. Preferably several recesses (5) are provided in order to be able to fix several means of attachment (1) of several return springs (2).

Preferably the flat bar (4) comprises several recesses (5) on both sides for fixing several return springs (2), as represented in figure 4, This will add to a greater stability of the whole.

The means of attachment (1) according to the invention are provided with two openings, more particularly a positioning opening (6) for positioning the means of attachment (1) with respect to the flat bar, and a fixing opening (7) for fixing the means of attachment (1) with respect to the flat bar (4). The positioning opening (6) ensures that the means of attachment (1) may shift all along the entire circumference of the flat bar (4) up to the exact position where the flat bar (4) is pulled, through the recess (5), into the fixing opening (7) of the means of attachment (1). The means of attachment (1) are intended to be able to move from the positioning opening (6) to the fixing opening (7) with respect to the flat bar (4), but after having been fixed with respect to the flat bar (4) should be unable to move back from the fixing opening (7) to the positioning opening (6) during operation or transport of the Jacquard machine. To that effect, a spring connection is provided between the positioning opening (6) and the fixing opening (7).

In a first embodiment of the means of attachment (1) for attaching a return spring (2) to a flat bar (4) in a

Jacquard weaving machine, this spring connection (8) is realized by providing a sharp and practically flat edge (9) in the fixing opening (7). Consequently, the means of attachment (1) will be unable to move from the fixing opening (7) to the positioning opening (6) with respect to the flat bar (4) during operation or transport of the Jacquard machine. In order to guide the motion of the means of attachment (1) from the positioning opening (6) to the fixing opening (7) with respect to the flat bar (4), a beveled edge (10) is provided in the positioning opening (6).

In a second embodiment of a spring connection (8) according to the invention, as represented in figure 6, two protrusions situated opposite one another, an upper (11a) and a lower (11b) protrusion, have been provided, together forming a kind of labyrinth. The purpose of this labyrinth is to make it yet more difficult for the means of attachment (1) to become detached with respect to the flat bar (4) during operation or transport of the Jacquard machine.

In a third embodiment of a spring connection (8) according to the invention, as represented in figure 7, the two protrusions (11a, 11b) of the labyrinth are moved further apart from one another. The upper protrusion (11a) is able to engage a recess (12), which has been provided, in the flat bar (4), as represented in figure 8. In this manner, it is almost impossible for the means of attachment (1) to become detached with respect to the flat bar (4) during operation or transport of the Jacquard machine.

Preferably the means of attachment (1) are made of synthetic material.

The flat bars (4) are carried out such that they may be immovably installed in a simple manner in the Jacquard weaving machine. Each flat bar (4) is inserted in two installing elements in the shape of a set of tubes (13) as represented in figure 9. These tubes (13) are provided with one or several grooves into which one or several flat bars (4) may be slid. Because of this, each flat bar (4) may take up an exact position in the Jacquard weaving machine. By attaching the flat bar (4) to the tubes (13), the tubes (13) may be put at a subatmospheric pressure or an overpressure in order to keep the flat bar (4) free of dust. Because this construction allows for a simple installation of the flat bars (4), it also offers the opportunity to build a more compact installation, which is an essential advantage in view of the building requirements for operating such installations.